

### REMARKS

Claim 24 has been amended to correct a typographical error pointed out by the Examiner. New claims 26 - 29 have been added. Reexamination and reconsideration of the application are respectfully requested.

The Examiner rejected claims 20, 22, 24 and 25 under 35 USC §103(a) as being unpatentable over *Barrow*. The rejection respectfully is traversed.

The claimed invention, as recited in independent claim 20, relates to a novel semiconductor device having a first bump unit, including a plurality of heat-radiating bumps that are disposed a first distance apart from each other, disposed in a central area of a back surface of the semiconductor device, and that radiate heat from a central portion of the semiconductor device. The semiconductor device also includes a second bump unit, comprising a plurality of connection bumps that are disposed a second distance apart from each other, disposed in a peripheral area of the back surface of the semiconductor device, for transmitting signals therefrom. The peripheral area surrounds the central portion of the back surface of the semiconductor device. Claim 20 further recites that the second distance that separates the bumps of the second bump unit is greater than the first distance that separates the bumps of the first bump unit, and further, the second distance is less than a third distance that separates the central area and the peripheral area of the back surface of the substrate.

On the other hand, it is acknowledged in the Office Action that *Barrow* does not teach or suggest the relationships between the width of the intermediate area

and the relationships of the distances that separate the bumps of the first and second bump units respectively.

Applicant disagrees with the assertion that the claimed relationships between such distances are merely "optimum or workable ranges" that involve "only routine skill in the art" that would render the claims obvious to one of ordinary skill. Rather, such features clearly patentably distinguish the pending claims from the teachings of *Barrow*, and any suggestions provided thereby, as explained below

*Barrow* describes solder balls 34 as being attached to solder pad 28, with no reference being made to any specific distancing of the solder balls based upon their placement along the solder pads, contrary to the claimed invention. Thus, *Barrow* fails to distinguish the structure of the different units of solder balls based on their different functions, and therefore it logically follows that *Barrow* fails to even contemplate the physical distance relationship of the solder balls of particular functions in reference to their placement along the solder pad.

The Examiner states that it would have been obvious to establish these relationships and pitches in the device of *Barrow*, since "it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art." The Examiner further indicates that although as stated in the MPEP, "applicants can rebut a prima facie case of obviousness based on overlapping ranges by showing unexpected results or criticality of the claimed range". . . . "in the specification

applicant has not shown either the unexpected results or the criticality of the claimed range of sizes" as would be necessary to make such a rebuttal.

It is submitted that that the standards and tests applied by the Examiner are not applicable to the present case. The invention claimed in claim 20 is not directed to specific ranges or sizes or distance, but to relative distance values ("greater than" or "less than"). The applicant has recognized particularly that whereas bringing the bumps of the first bump unit closer together has the advantages for radiating heat, maintaining the distance between the bumps of the second bump unit assures that the signals carried thereon will not be shorted. Further, reducing the distance between the bumps of the first bump unit relative to that between the bumps of the second bump unit facilitates fusing together of the bumps of the first bump unit when heated for connection purposes, thereby to improve heat dissipation characteristics, while maintaining a distance between the bumps of the second bump unit to avoid shorting. These advantages are nowhere shown or suggested by *Barrow*.

Consequently, it is respectfully submitted that independent claim 20, as well as its pending dependent claims 22, 24 and 25, are clearly not obvious in view of the teachings of *Barrow*, and accordingly the rejection under 35 U.S.C. §103(a) over *Barrow* should be withdrawn.


New claims 26 - 29 emphasize the characteristics of the bump units in response to a heat treatment contemplated in the use of the invention namely that the distance between the bumps of the first bump unit and the distance between the bumps of the second bump unit are set such that upon application of a heat

treatment to the device. the bumps of the first bump unit melt so as to become connected and fuse to each other as a unitary body. and the melted bumps of the second bump unit remain apart from each other.

All objections and rejections having been addressed, it is respectfully submitted that the application is in condition for allowance, and a Notice, with allowed claims 20, 22, 24 and 25-29, is earnestly solicited.

Respectfully submitted,

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Date

  
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**MARKED UP CLAIM**

24. (Amended) The semiconductor device in accordance with Claim 22, wherein said plurality of bumps included in said second bump unit is greater in quantity than said plurality of bumps included in said first bump unit.